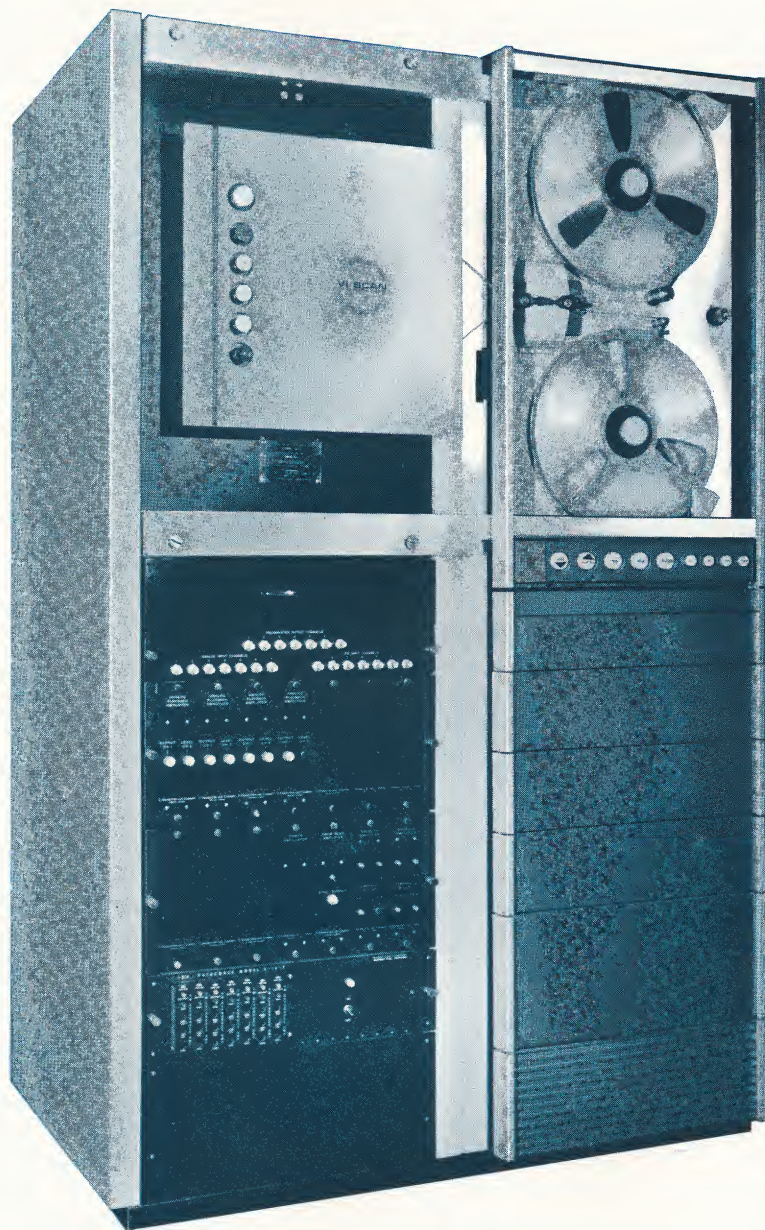


TECHNICAL SPECIFICATION—

VI/SCANTM III

***Military Designation: Recorder/Reproducer Set Signal Data AN/FSH-6 (XB-3)**



for

- *Transient Analysis*
- *SNR Enhancement*
- *Correlation Analysis*
- *Speech Compression*

•

VI/SCAN III
*is an IRIG
Compatible
System
Using the
VI/SCAN
Data
Processing
Technique.*

•

*Produced for Naval Research Laboratory under Contract Nonr-3906(00) (X)

S. HIMMELSTEIN AND COMPANY

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VI/SCAN_{TM} III System

GENERAL DESCRIPTION

VI/SCAN III is a complete record/reproduce system incorporating the unique data processing features of the VI/SCAN technique. It is capable of recording and reproducing up to 7 channels of information on 1/2 inch wide tape. Recording may be done in either Direct or FM mode - both compatible with IRIG analog tape standards per Document No. 106-60. Recorded tapes may be processed on a real time basis using a dual scan length headwheel. A pre-recorded IRIG format tape may also be processed.

Scan length is either 4" or 8" using the same headwheel. Adjustable arms permit changing the tape wrap angle and automatic switching is used to enable and/or disable heads used for each scan length. Three electrically changeable motor speeds provide 3 scanning rates. Equalizers, center frequency determining networks and low pass filters are plug-in modules. As each odd head stack enters the scan area a fast synchronizing pulse is automatically generated independent of the signal circuits.

SYSTEM CHARACTERISTICS

TEMPERATURE: Operating temperature range is 50° to 110° F.

SIZE & WEIGHT: 73-1/4" high x 47" wide x 28-1/4" deep--weighing 1,400 pounds for a 7-channel system.

SCANNING SUBSYSTEM CHARACTERISTICS

One dual scan length headwheel for 1/2 inch wide tape is provided. The following tabulation summarizes the scanning parameters it provides. The tape scan angle (mechanical angle defined by tangent points between wheel and tape) is adjustable over $\pm 10^\circ$.

All magnetic head stacks conform to IRIG Standards, i.e., azimuth angle is $90^\circ 00' \pm 1'$, gap scatter is ± 50 microinches, track location is $0.070" \pm 0.002"$ center-to-center, effective track width is $0.050" \pm 0.002"$. Separation of interlaced stacks is non-IRIG

Head and tape wear are virtually eliminated by providing a thin, stable air film for high speed operation. An electrically interlocked combination safety/dust cover encloses the headwheel assembly and shields operating personnel. Equipment construction conforms to the highest instrumentation standards. All critical points in the drive system use high precision permanently lubricated bearings, stainless steel shafts, tape guides, etc. MCRT's (Multi-Channel Rotary Transformers) are used for coupling electrical signals from the rotating head assembly.

VI/SCAN III incorporates a CEC Type GR-2800 IRIG Record/Reproduce System. The IRIG transport may be utilized independently of the scanning subsystem. When used for VI/SCAN processing, all control circuits are interlocked for proper start-up/shut-down sequences, correct tape tension and safety factors. All normal transport control modes are operable after the start-up cycle is completed.

POWER: Nominal 115 volts, 60 cps, single phase. Maximum requirement for 7-channel system is 1.5 kva. Regulated d.c. power is internally generated by solid state supplies. Circuit breakers are provided to safeguard all A.C. input lines.

to permit completely bidirectional operation; i.e., all stacks are spaced 2.00" apart. Head construction is all metal.

WOW & FLUTTER: Angular flutter of the headwheel, with tape either in motion or stopped, is 0.3% peak-to-peak maximum measured over a bandwidth from 0.5 to 300 cps.

CONTROLS: Fully interlocked manual controls are provided for the following functions: SCANNING SPEED, FORWARD, REVERSE, STOP, POWER ON, POWER OFF.

STANDARD HEADWHEEL PARAMETERS

VI/SCAN III is equipped with a dual scan length headwheel. Either a 4" scan length or an 8" scan length may be obtained by changing the tape wrap angle - controlled by two adjustable roller guides. The head-

wheel contains 4 pairs (odd and even) of headstacks. Two pair are automatically switched out when the 8" scan length is selected. Important headwheel parameters are summarized below:

TABLE I

Scan Length:	4" $\pm$ 0.007"	8" $\pm$ 0.007"
Scan Angle (nominal)	90°	180°
Distance From Record Head To Start of Scan:		
From Odd Stack	22-1/2"	20-1/2"
From Even Stack	21"	19"
Scanning Direction	bi-directional	bi-directional
Scan Velocity* @ 225 RPM	60 ips @ 15 SPS**	- - - - -
Scan Velocity @ 450 RPM	120 ips @ 30 SPS	120 ips @ 15 SPS
Scan Velocity @ 900 RPM	- - - - -	240 ips @ 30 SPS

*For line frequency of 60 cps, tolerance of scanning velocity and rate is $\pm 0.1\%$. Scan Velocity is circumferential velocity of scanning; actual head-to-tape speed is Scan Velocity plus or minus (headwheel is bi-directional) linear tape speed. Scan Rate is the quotient of Scan Velocity and Scan Length. If the tape is in motion while it is being scanned, the effective scan rate may be computed as follows:

$$\text{Effective Scan Rate} = \frac{\text{Scan Velocity}}{\text{Scan Length}} \mp \frac{\text{Linear Tape Speed}}{\text{Scan Length}}$$

With the tape in motion, the number of times each segment of tape is scanned may be computed as follows:

$$\text{Number of Scans} = \frac{\text{Scan Velocity}}{\text{Tape Speed}} \pm 1$$

Where + sign is used when Scan Vector is in direction opposite to tape motion.

EXAMPLE: Tape Speed = 1-7/8 ips, Scan Velocity = 240 ips in direction of tape travel, Scan Length = 8".

$$\text{Effective Scan Rate} = 29.77 \text{ SPS}$$

$$\text{Number of Scans} = 121$$

**SPS = Scans per second.

SCANNING REPRODUCE ELECTRONICS

Modular construction is used throughout. With the exception of Nuistor coupling and output stages in the Video Post-Amplifier package, all electronic circuitry (video pre-amplifiers, regulated power supplies, etc.) is solid state. Standard input and output

(signal) connectors are BNC. Any combination of Direct or FM channels up to a maximum of seven can be provided. Speed/bandwidth changes are accomplished by changing plug-in networks in the FM demodulators (center frequency and low pass filter) and

analog post amplifiers (equalizers). Direct recording mode response is flat within ± 3 db

over the indicated bandwidth; response deviation is within ± 0.5 db for the FM mode.

TABLE II
STANDARD VI/SCAN III BANDWIDTH VERSUS SCANNING PARAMETERS

Scan Rate (Scans/Sec.)	SCAN LENGTHS			
	DIRECT MODE		FM MODE	
	4"	8"	4"	8"
15	2-120 KC	4-240 KC	DC-10 KC	DC-20 KC
30	4-240 KC	8-480 KC	DC-20 KC	DC-40 KC

HARMONIC DISTORTION: Direct Mode-When a 10 kc signal is recorded at 60 ips and scanned at any scanning rate; the third harmonic distortion will be less than 1% @ rated output level. FM Mode-Maximum total harmonic distortion is 1.5%.

OUTPUT LEVEL: Direct Mode-1 volt RMS into 1,000 ohms. FM Mode-1 volt RMS into 10,000 ohms.

OUTPUT IMPEDANCE: Direct Mode-Less than 100 ohms. FM Mode Less than 1,000 ohms.

SIGNAL-TO-NOISE RATIO: Direct Mode-RMS Signal-to-RMS Noise ratio is at least 30 db when measured over the scanning bandwidth, worst case--with the amplitude of any signal frequency within the pass-

band used as a reference. FM MODE-RMS to RMS SNR at least 40 db at maximum input level.

FM SQUELCH CIRCUITRY: Each FM channel has a squelch circuit which automatically quiets whenever the carrier disappears, i.e., headwheel rotation is stopped or the channel is unrecorded. Separate threshold level adjustments are used for each channel. The level is automatically switched when the headwheel speed is changed.

SYNCH PULSE SYSTEM: A Synch Pulse is generated each time an odd (IRIG) head-stack enters the scan area. The pulse is positive going with a maximum rise time of 0.5 microseconds and a minimum peak amplitude of 8 volts. Output impedance is less than 100 ohms.

IRIG TRANSPORT SUBSYSTEM

The following abbreviated specifications apply when a CEC GR-2800 subsystem is supplied as part of VI/SCAN.

TAPE SPEEDS: 60, 30, 15, 7.5, 3.75, 1.875 ips; all $\pm 0.2\%$ at 60 cps line frequency.

TAPE CAPACITY: Accommodates NAB hub equipped reels up to 14" in diameter; either 1/2 inch or 1 inch wide tapes with either 1 mil or 1-1/2 mil polyester base.

WOW & FLUTTER: Less than 0.25% peak-to-peak over a 0.2 cps to 10 KC bandwidth at 60 ips.

START TIME: 3 seconds.

STOP TIME: 2 seconds.

TAPE MOTION CONTROLS: Fast Forward, Rewind, Stop, Reproduce, Record.

FREQUENCY RESPONSE: Direct Mode-100 cps to 100 KC at 60 ips; flat within ± 3 db. Proportionately lower at other tape speeds. FM Mode-DC to 10KC at 60 ips, flat within ± 0.5 db. Proportionately lower at other tape speeds.

SIGNAL-TO-NOISE RATIO: Direct Mode-At least 32 db RMS signal-to-RMS Noise. FM Mode-At least 40 db, RMS-RMS.

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IMPELLOR™ II

HIGH PERFORMANCE TAPE LOOP TRANSPORT

UNEXCELLED FOR:

- Fast Power Spectral Density Analysis
- Correlation Studies
- Wide Range, Wide Bandwidth Time Delay Synthesis
- Pre and Post Fault/Transient Recording



FEATURES: 7½ to 240 ips Tape Speeds—in six binary steps.

High Loop Repetition Rates—up to 6.7 per second.

Superior, Low Wear Tape Handling—achieved by pinch rollerless vacuum drive, tensioning, and buffering.

Reliable, Stable Machine Performance—resulting from the use of pneumatic techniques and dynamic braking.

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IMPELLOR II Technical Specifications

Tape Speeds: Six fixed speeds in two ranges. High Range—240 ips, 120 ips, 60 ips. Low Range—30 ips, 15 ips, 7.5 ips. Range switching is accomplished by changing drive belt position.

Tape Speed Stability: Long-term speed variation is less than 0.25% assuming constant line frequency and voltage.

Absolute Tape Speed Accuracy: $\pm 0.25\%$ assuming 60 cps power line frequency.

Wow and Flutter: At a tape speed of 120 ips, maximum cumulative peak-to-peak flutter measured over a bandwidth from 1 to 10,000 cps is 0.8% with a gravity loop store; 2% with a Standard Cartridge loop store; and 0.75% with the Optional Magazine loop store.

Start Time: Less than 10 seconds at 240 ips and 3 seconds at 30 ips.

Stop Time: Less than 5 seconds from 240 ips and 2 seconds from 30 ips.

Tape Tension: Continuously adjustable to 16 ounces per inch of tape width.

Tape Width: Machine comes equipped to handle a single tape width; $\frac{1}{4}$ ", $\frac{1}{2}$ " or 1" as ordered. Other tape width change kits can be supplied as optional equipment.

Tape Type: Handles paper, plastic and metal base tapes.

Tape Thickness: Overall thickness between 0.00025" and 0.010".

Adjustable Head Positioners: As an extra cost option, two-axis adjustable head plates can be provided. They are interchangeable with standard fixed units and provide a total head travel of 2.25" along the tape and 1.00" across the tape. Positional information readout is accurate to 0.001".

Fixed Head Baseplates: One each standard Upper and Lower baseplates are supplied. Each baseplate has 2 miniature 36 Pin Blue Ribbon Connectors installed; Type 57-10360. Additional baseplates are available at nominal cost.

Loop Capacity: 5' to 50' for Standard Cartridge, 36" to approximately twice the maximum available vertical free drop for a gravity Loop and 10' to 650' (1.5 mils thick) for the optional Magazine. IMPELLOR II comes equipped with one Standard Cartridge for $\frac{1}{4}$ ", $\frac{1}{2}$ " or 1" wide tape as specified, loaded with 48 ± 2 feet of instrumentation grade tape. A cartridge with 100' capacity is available as optional equipment.

Controls and Indicators: ON/OFF Switch is coupled to the Speed Control. Two illuminated pushbutton switches are used for tape START and STOP

Remote Control: Tape motion can be remotely controlled via input to rear connector. Control requirements are: RUN—Floating Contact Closure, STOP—Open Run Contacts. Front panel mounted lights and tape speed monitor function in REMOTE Mode.

Input Power: 105 to 125 volts, 60 cps, single phase at 7.5 amperes, maximum.

Size: $8\frac{3}{4}$ " of vertical mounting space and $18\frac{1}{8}$ " of depth in standard 19" rack. Additional outboard vertical space required for loop storage.

Weight: 165 pounds.

Slide Mounts: Mounting slides are available as an extra cost option.

Standard Accessories: IMPELLOR comes equipped with a line cord and mating connectors for Remote control and Heads.

Head Cabling: At extra cost, baseplate receptacle connectors may be connected via coaxial cabling to 4 output connectors at the rear chassis; 36 pin Miniature Blue Ribbon, Type 57-40360.

Tape Guides: Non-magnetic stainless steel guides for $\frac{1}{4}$ ", $\frac{1}{2}$ " and 1" wide tape are available at extra cost. When mounted on IMPELLOR baseplates, they correctly center the tape path and accurately reference the tape edge to the head mounting reference surface.

Head Mounting Service: If desired, customer supplied heads and guides can be factory mounted and wired on standard or adjustable baseplates. Send drawings showing envelope, mounting arrangement with tolerances, desired wrap angle and electrical connections for a quotation.

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PRODUCT PROFILE—

IMPELLOR™ I

MULTI-PURPOSE ENDLESS LOOP TAPE TRANSPORT

AN EXCEPTIONALLY versatile and reliable tape transport uniquely suited for tape testing, head testing and magnetic tape system development. Its unusual operating characteristics make feasible the economical development of multi-channel, wideband delay lines, recirculating memories, bandwidth compressor/expanders, transient spectrum analyzers, transient recorders and related memory/data-analysis devices.



SIMPLE, wide range controls and adjustments permit routine changing of all important tape/head/drive transport parameters. Important features and options which can be readily combined *without restrictions* include:

PNEUMATIC TAPE DRIVE—eliminates pinch rollers and associated mechanisms.

THREE TAPE WIDTHS—interchangeable tape path components for 1/4", 1/2" and 1" tapes.

INTERCHANGEABLE TAPE TYPES—handles paper, plastic and metal base tapes 0.00025" to 0.010" thick.

VARIABLE LOOP LENGTHS—any loop length from 40' to 50' accommodated by standard loop stores. Optional magazine has a 650 foot capacity.

VARIABLE TAPE SPEED—15/16 to 250 inches/second.

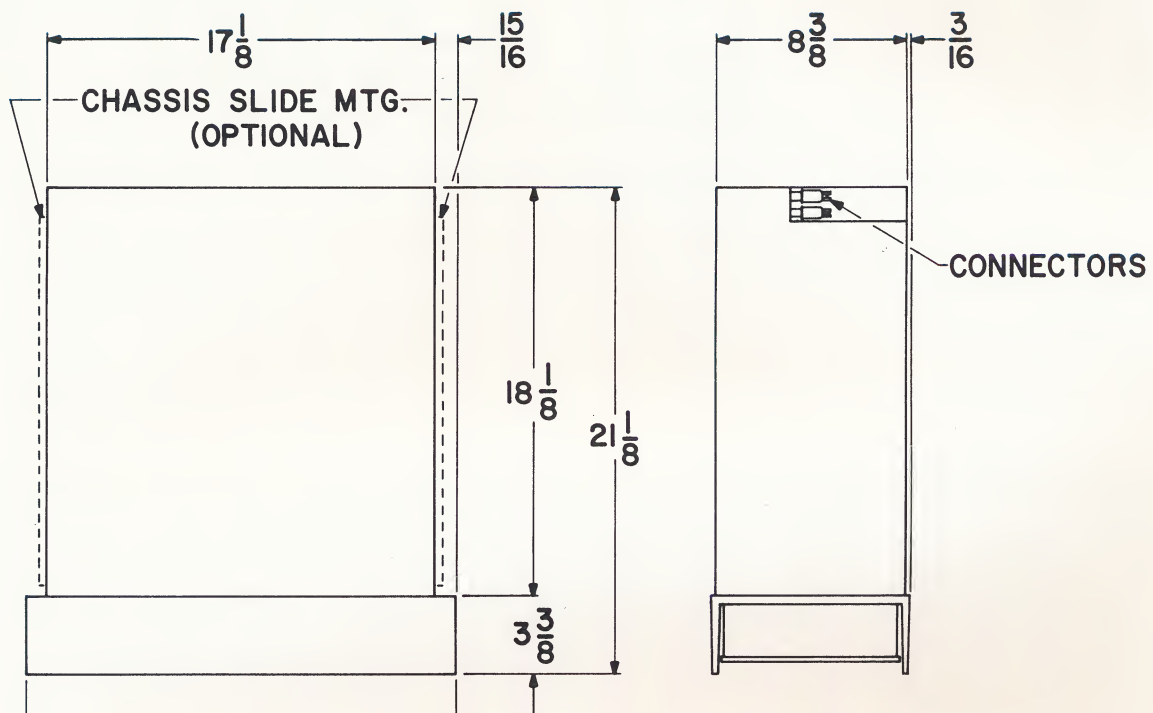
VARIABLE TAPE TENSION—continuously adjustable to 16 ounces per inch of tape width.

CONVENIENT HEAD MOUNTING—2 separate precision baseplates provide large head, guide and preamplifier mounting space.

TWO-AXIS HEAD POSITIONER—accurately calibrated (0.001") table positions special head mounting plates along and/or across the tape path.

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NOTES
 1-DIMENSIONS ARE FOR REFERENCE ONLY
 2-SLOTTED MOUNTING HOLES SUPPLIED ONLY IF SPECIFIED

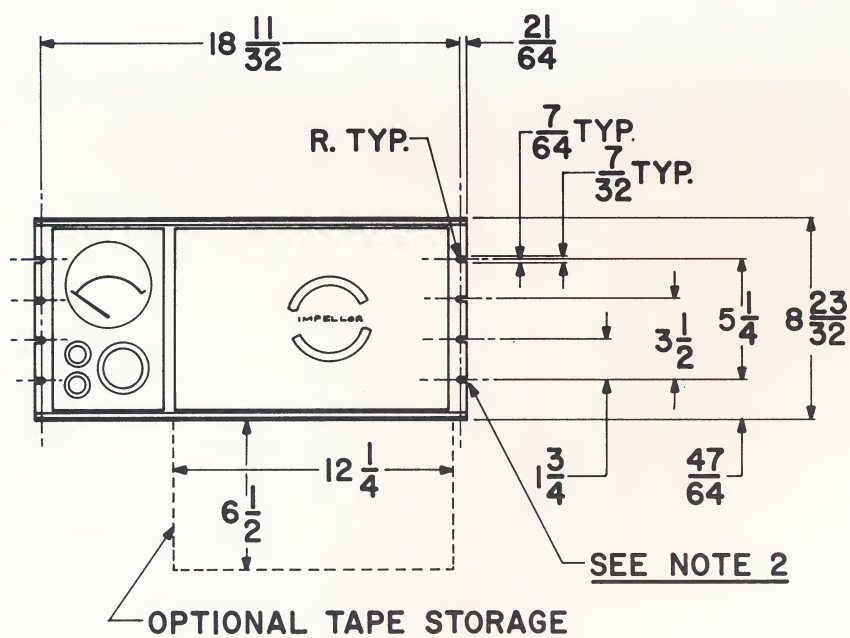


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IMPELLOR I—General Description

IMPELLOR I is a reliable, instrumentation-grade tape loop drive mechanism which, in combination with standard and optional components, provides an extremely wide range of operating conditions. Using it, one may rapidly vary tape system parameters such as tape speed, tape tension, tape width, tape thickness, head configuration, etc. The operating characteristics and reliability of system components (heads, tape, circuitry, etc.) may be rapidly and economically measured with its aid. Furthermore, complete record/playback systems can be breadboarded and de-bugged without premature mechanical design of new transports or costly modifications of existing ones. After the desired transport characteristics have been conclusively established by *actual system tests*, a specialized transport can be developed, if required. In that connec-

tion, single purpose versions of IMPELLOR I are available on an O.E.M. basis permitting fast, low-cost conversion of an operating breadboard into a production system. Your inquiries are invited.

To facilitate head and guide installation, standard baseplates come equipped with mating connectors installed on the IMPELLOR Deck. Baseplates are securely held against precisely machined surfaces of the deck casting and, when installed, are accurately referenced to the tape path. Standard baseplates may be replaced by an interchangeable two-axis adjustable plate which can position mounted heads a total of $2\frac{1}{4}$ " along and 1" across the tape. Positional readout accuracy is ± 0.001 ". Co-axial cabling can be installed to chassis connectors at the rear of the deck.

Important Features

IMPELLOR I incorporates advanced tape handling techniques to protect the tape, to insure positive, precise tape drive, and to provide maximum reliability during continuous hard usage. Design features which contribute to the achievement of these desirable characteristics are:

PNEUMATIC TAPE DRIVE—

THE TAPE is driven through its backing surface by a pneumatic capstan and only the tape backing makes contact with the drive system components. Because pinch rollers have been eliminated, it is not possible to damage the tape surface by repeated pinch roller engagement or contaminate it with foreign particles deposited by continuously contacting pinch rollers. With the pneumatic capstan, non-uniform stress distribution across the tape, caused by pinch roller misadjustment, is not possible. Thus, a major source of uneven head wear and of drive system caused tape skew has been eliminated.

PNEUMATIC TAPE TENSIONING—

PNEUMATIC techniques are used to provide constant and uniformly distributed tape tension and to buffer the head

area from tension transients. The possibilities of introducing variations, wear and/or misadjustments in mechanical tensioning devices have been eliminated. This system is also used to vacuum clean loose particles (whether oxide, binder or outside contaminant) *before* the tape enters the head area.

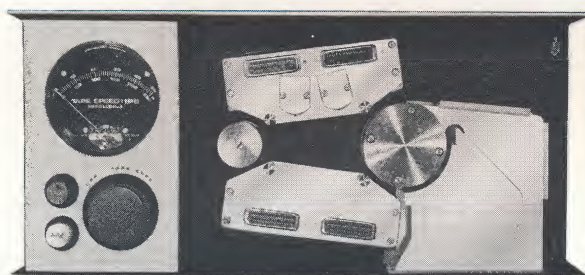
GENTLE, UNIFORM TAPE ACCELERATION—

EXCESSIVE tape tensions caused by fast, uncontrolled or improperly adjusted tape starting (or stopping) are not possible in the IMPELLOR tape deck. Tape acceleration is uniform and gentle. The tape is accelerated (or decelerated) with the capstan, i.e., both the capstan and tape are brought up-to-speed or stopped together. This procedure avoids the introduction of shock transients associated with high tape accelerations—conventionally accomplished by clamping tape to a rotating capstan. Furthermore, tape elongation cannot be introduced from mismatch or misadjustment of reel motor and actuator acceleration characteristics. Dynamic braking is used instead of mechanical brakes and produces uniform deceleration *intrinsically unaffected by wear and use*.

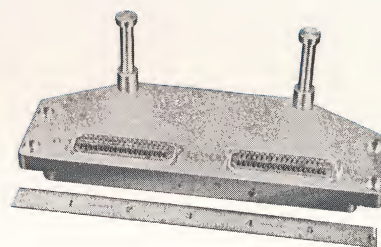
BEYOND ITS INHERENTLY superior design features, IMPELLOR I is constructed to the highest instrumentation standards for quality and workmanship. All components are conservatively rated. Bearings are permanently lubricated, shielded, precision ball types; the tape deck is built around a rigid, stabilized casting; all tape path components including baseplates are accurately referenced to machined surfaces of the deck casting; metal surfaces are treated for protection and life. *Under the most severe combination of specified operating conditions, no component will be overloaded, or fail prematurely.*



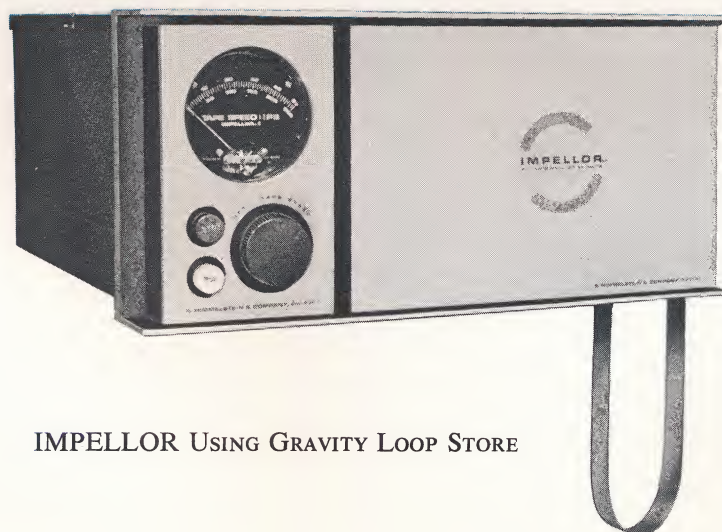
IMPELLOR Using CARTRIDGE AND/OR MAGAZINE LOOP STORE



IMPELLOR With HEADS MOUNTED



HEAD BASEPLATE With TAPE GUIDES



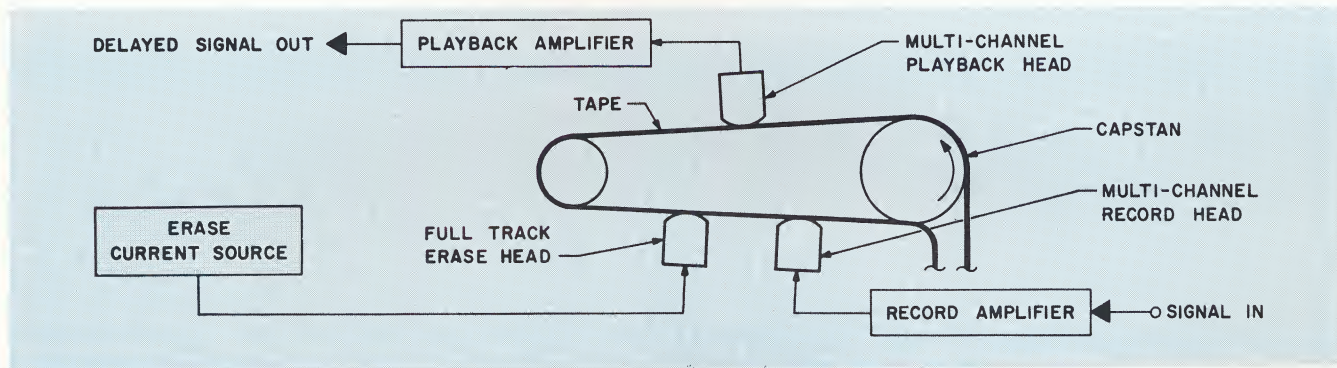
IMPELLOR Using GRAVITY LOOP STORE

Examples of Unique IMPELLOR I System Applications

THE FOLLOWING PARAGRAPHS summarize some unusual systems that may be constructed, using IMPELLOR I and which are made possible by unique IMPELLOR operating characteristics. IMPELLOR may be used for recording in Direct (Analog), Frequency Modulation (FM), Pulse Duration Modulation (PDM) or Digital (including PCM) modes. Consequently, the maximum bandwidth of the systems described below will vary with the type of recording scheme used. To simplify this dis-

cussion, we will assume that Direct recording is being used with conventional (IRIG Document 106-60) bandwidths or with extended bandwidths. Conventional bandwidth systems have a minimum recorded wavelength of 0.0006". Extended bandwidth systems, as used here, have a minimum recorded wavelength of 0.0002". Greater bandwidth extension (minimum wavelength of 0.00008" corresponding to 3.125 MC @ 250 ips) is possible with current state-of-the-art techniques.

Long, Wide Bandwidth Multi-Channel Time Delay



EACH channel is continuously delayed by a fixed time determined by loop length and tape speed. Table I summarizes

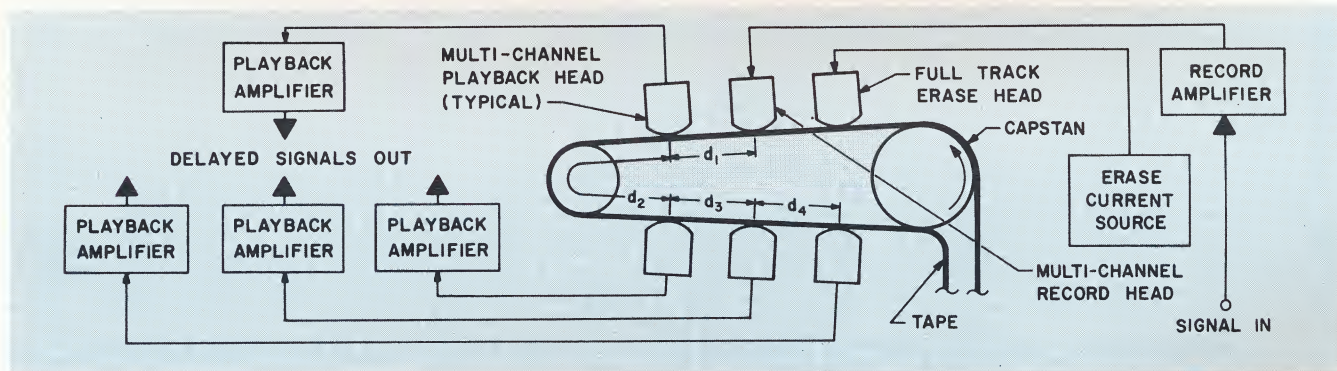
IMPELLOR I long time delay capabilities and bandwidths obtainable using the record parameters described above.

TABLE I—LONG TIME DELAY RANGE AND BANDWIDTH

Loop Store	Tape Speed	Time Delay		Maximum System Bandwidth	
		Maximum	Minimum	Conventional System	Extended System
Standard	15/16 ips	640 sec.	64 sec.	1.56 kc	4.67 kc
Cartridge	250 ips	2.4 sec.	0.24 sec.	417 kc	1.25 mc
Optional	15/16 ips	8300 sec.	128 sec.	1.56 kc	4.67 kc
Magazine	250 ips	31 sec.	0.48 sec.	417 kc	1.25 mc

NOTES: 1) Time delay is directly proportional to loop length and inversely proportional to tape speed
2) Maximum bandwidth is directly proportional to tape speed.

Short, Wide Bandwidth Multi-Channel Time Delay



EACH INPUT CHANNEL is continuously delayed by a fixed time determined by the distance (d_1) between the gap line of the record head and the reproduce head and the tape speed. Additional discrete delays are obtained for each playback head-stack; each such delay is proportional to the distance between

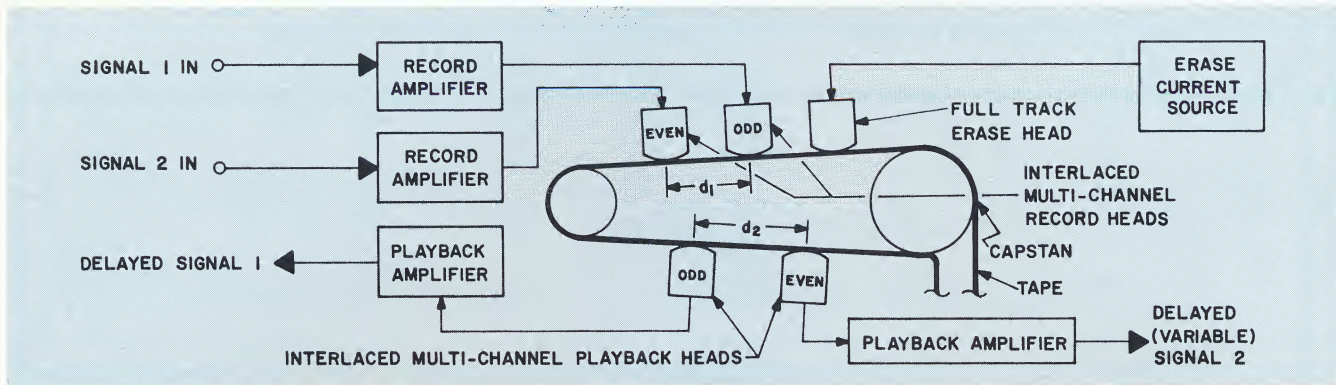
the record head gap line and the playback head gap line. Assuming a distance of 0.8" between the gap lines of the record head and first playback head (conservative on the basis of head configurations available from independent suppliers), Table II gives the minimum time delays obtainable.

TABLE II—MINIMUM OBTAINABLE TIME DELAYS

Tape Speed	Minimum Time Delay
15/16 ips	0.85 seconds
250 ips	3.2 milliseconds

NOTES: 1) See Table I for maximum system bandwidths.
2) Time delay is inversely proportional to tape speed.

Ultra-Short, Wide Bandwidth, Channel-to-Channel Time Delay



THERE IS A CONTINUOUS time delay between each input channel and each output channel as explained for the examples on Page 6. In addition, there is a differential time delay between Input No. 1 and Input No. 2. Using a special head positioning table, the distance d_2 can be adjusted so that it varies from less to greater than the distance d_1 . Hence, the time delay between these groups of channels (odd and even) can be made to vary from a negative (an effective speed up)

through zero, to a positive (or real) delay. IMPELLOR I deck geometry is such that differential delays anywhere within the range from -3.2 milliseconds thru $+3.2$ milliseconds are obtainable at 250 ips with an adjustment resolution of 4 microseconds. At 15/16 ips, the differential delays possible vary from -0.85 seconds to $+0.85$ seconds and have an adjustment resolution of 1 millisecond. Refer to Table I for applicable system bandwidth.

VARIABLE TIME DELAY

THE DELAY time obtained with the three arrangements described can be conveniently varied. For all examples, changing the distance between the record and playback head varies the time delay. This method, which includes possibility of using more than one playback head and the use of the optional adjustable head positioning table, has no effect on system bandwidth. For the first example cited on Page 6, the length of the tape loop may be varied, again changing the time delay without affecting bandwidth. For all examples, the tape speed may be varied with accompanying proportional changes in maximum attainable bandwidth. See Table I for bandwidth range.

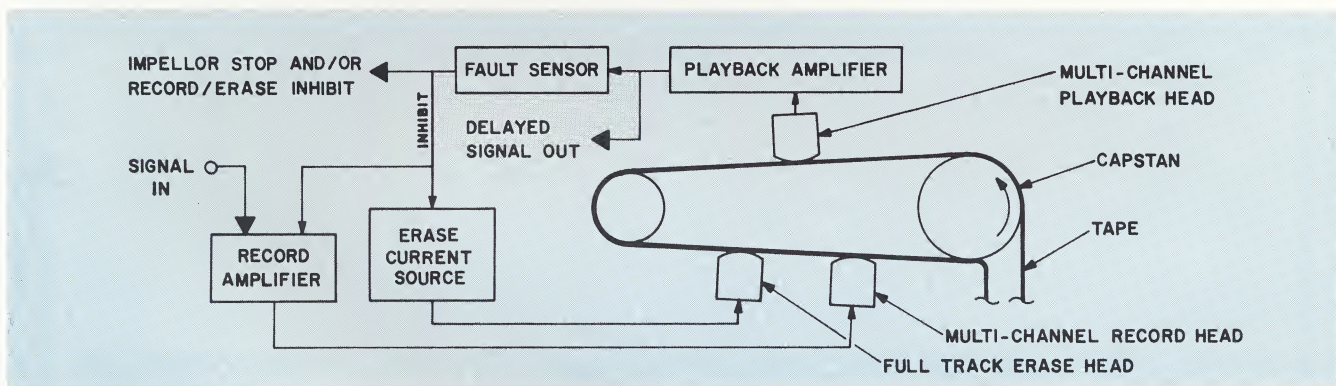
RECIRCULATING MEMORY

FOR the first three examples cited here, a recirculating memory can be achieved merely by turning off current to the record and erase head-stacks after a recording cycle is completed. Then, recorded information may be continuously played back or recirculated as often as required. Furthermore, data may be erased and up-dated when necessary. The use of multiple playback heads yields a tapped delay line.

WIDE RANGE BANDWIDTH EXPANDER/COMPRESSOR

IF A RECORDING is made on IMPELLOR I in conventional manner, its bandwidth can be expanded or compressed merely by changing the playback tape speed. Recorded data may be repeatedly analyzed at one or more speeds with convenient, infinite resolution ratio adjustments and with a maximum ratio greater than 250 to 1. If desired, to further increase the flexibility of the IMPELLOR, with particular application to transient spectrum, correlation analysis and SNR enhancement, a rotating headwheel may be incorporated in the tape path. Standard S. Himmelstein and Company headwheels with scans up to 8" long can be accommodated. Write for literature on our VI/SCAN Systems for an explanation of the advantages of this repetitive, fast scanning headwheel technique.

Multi-Channel Pre- and Post Fault Recorder



THE FAULT SENSOR illustrated is a circuit that recognizes the presence of a fault (or transient) of interest, during playback, and then generates a stop command for the IMPELLOR drive or, optionally, as shown, simultaneously generates an inhibit command for the record and erase circuits. This IMPELLOR I system will continuously cycle tape, record and erase data on each of its input channels. When a fault or transient occurs, it

will be recorded in its entirety including conditions before and after the fault, and then the recording cycle will be stopped. The data thus recorded may be immediately subjected to detailed repetitive analysis, bandwidth compression (for recording high frequency data on paper charts), etc. again utilizing unique IMPELLOR characteristics. Alternately, IMPELLOR may be remotely interrogated for fault data.

IMPELLOR I Technical Specifications

Tape Speeds: Tape speed is continuously variable in two overlapping ranges; 3¾ ips to 50 ips and 15 ips to 250 ips. Speeds above and below these figures can be obtained in each range. However, performance specifications only apply when operated within the limits indicated. As an option the speed range can be extended to 15/16 ips.

Tape Speed Stability: Long-term tape speed variation is less than $\pm 1\%$, assuming constant line voltage and constant tape tension.

Wow and Flutter: At a tape speed of 120 ips, maximum cumulative peak-to-peak flutter measured over a bandwidth from 1 to 10,000 cps is 1% with a gravity loop store; 2% with a standard Cartridge loop store; and 0.75% with the Optional Magazine loop store.

Start Time: Less than 12 seconds at 250 ips and 6 seconds at 125 ips in Remote Mode. In Manual Mode, the ON/OFF Switch is coupled to the Speed Control so that Start Time is a function of manual setting.

Stop Time: Less than 6 seconds from 250 ips and 3 seconds from 125 ips.

Tape Tension: Continuously adjustable to 16 ounces per inch of tape width.

Tape Width: Standard interchangeable deck components provided for ¼", ½" and 1" wide tapes. Other widths narrower than 1" can be handled on special order.

Tape Type: Handles paper, plastic and metal base tapes.

Tape Thickness: Overall thickness between 0.00025" and 0.010".

Adjustable Head Positioners: As an extra cost option, two-axis adjustable head plates can be provided. They are interchangeable with standard fixed units and provide a total head travel of 2.25" along the tape and 1.00" across the tape. Positional information readout is accurate to 0.001".

Fixed Head Baseplates: One each standard Upper and Lower baseplates are supplied. Each baseplate has 2 miniature 36 Pin Blue Ribbon Connectors installed; Type 57-10360. Additional baseplates are available at nominal cost.

Loop Capacity: 5' to 50' for standard Cartridge, 40" to approximately twice the maximum available vertical free drop for a gravity Loop and 10' to 650' (1.5 mils thick) for the optional Magazine. IMPELLOR I comes equipped with one each standard Cartridge for ¼", ½" and 1" wide tape each loaded with 48 ± 2 feet of instrumentation grade tape.

Controls and Indicators: ON/OFF is combined with continuously variable Speed Control. Two illuminated pushbutton switches are used for tape START and STOP.

Tape Speed Monitor: 4½" meter, 50/250 ips $\pm 1\%$ full scale.

Remote Control: Tape motion can be remotely controlled via input to rear connector. Control requirements are: RUN—Floating Contact Closure, STOP—Open Run Contacts. Front panel mounted lights and tape speed monitor function in REMOTE Mode.

Input Power: 105 to 125 volts, 60 cps, single phase at 7.5 amperes, maximum.

Size: 8¾" of vertical mounting space and 18⅛" of depth in standard 19" rack. Additional outboard vertical space required for loop storage.

Weight: 125 pounds.

Slide Mounts: Mounting slides are available as an extra cost option.

Head Cabling: At extra cost, baseplate receptacle connectors may be connected via coaxial cabling to 4 output connectors at the rear chassis; 36 pin Miniature Blue Ribbon, Type 57-40360.

Tape Guides: Non-magnetic stainless steel guides for ¼", ½" and 1" wide tape are available at extra cost. When mounted on IMPELLOR baseplates, they correctly center the tape path and accurately reference the tape edge to the head mounting reference surface.

Head Mounting Service: If desired, customer supplied heads and guides can be factory mounted and wired on standard or adjustable baseplates. Send drawings showing envelope, mounting arrangement with tolerances, desired wrap angle and electrical connections for a quotation.

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